Vol. I July, 1916 No. 7

CATALOGUED
JUL 25 1938

MONTHLY BULLETIN

OF THE

OHIO Agricultural Experiment Station

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Wooster, Ohio, U. S. A.

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Monthly Bulletin

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CONTENTS OF VOL. I, NO. 7

JULY, 1916

Page

VARIETY TESTS OF WHEAT —
C. G. Williams 195

WINTER INJURY OF ALFALFA AND CLOVER —
C. A. Gearhart 199

FORAGE CROPS FOR SWINE —
W. L. Robison 201

RIPENING OF GROWING PARTS OF ORCHARD TREES AND SHRUBBERY —
A. D. Selby 206

SOME ALKALI SOILS IN OHIO —
J. W. Ames 209

THE INFLUENCE OF SIRES ON PRODUCTION —
C. C. Hayden 211

SOME LESSONS FROM THE WHEAT CROP OF 1915 —
C. E. Thorne 215

CROWN GALL ON RASPBERRIES AND BLACKBERRIES —
Paul Thayer 218

THE IODINE CONTENT OF FOODS —
E. B. Forbes 219

TWO TROUBLESOME PESTS OF MAN —
R. D. Whitmarsh 221

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Wheat harvest on the Ohio Experiment Station farm

MONTHLY BULLETIN

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VOL. I JULY, 1916 No. 7

VARIETY TESTS OF WHEAT[1]

C. G. WILLIAMS

This Station has grown several different varieties of wheat during the period covered by this report. Most of them have been discarded for one reason or another. None has been included which has not been tested for 8 consecutive years. This excludes a number of varieties of merit which have not yet been thoroughly tested. In Table I data are given with respect to 28 varieties as to yield of grain and straw, the presence of beards and the color of grain and chaff.

TABLE I.—Twenty-eight varieties of wheat

Variety	Bearded or smooth	Color		Average yield of grain per acre in periods of		Eight-year average yield of straw per	
		Grain	Chaff	Eighteen years 1898-1915	Eight years 1908-1915	Acre	Bushel of grain
				Bushels	Bushels	Pounds	Pounds
American Bronze	Smooth	Red	White	28.59	33.96	3,942	116.1
Buda Pesth	Bearded	Red	White	29.16	34.29	3,695	107.7
Dawson's Golden Chaff	Smooth	White	Red	32.27	38.31	3,976	103.8
Deitz	Bearded	Red	White	30.13	34.48	3,960	114.8
Early Red Clawson	Smooth	Red	Red	29.80	36.63	3,961	108.1
Early Ripe	Smooth	Red	Red	30.14	33.17	4,124	124.3
Fulcaster	Bearded	Red	White	29.57	33.20	3,917	118.0
Fultz	Smooth	Red	White	29.60	34.63	3,853	111.3
Fultzo-Mediterranean	Smooth	Red	White	29.53	35.38	3,340	94.4
Gladden	Bearded	Red	White	.....	37.62	4,259	113.2
Golden Coin	Smooth	White	Red	30.93	38.15	3,867	101.4
Gypsy	Bearded	Red	White	31.27	33.99	4,066	119.6
Harvest King	Smooth	Red	Red	31.17	36.53	3,602	98.6
Hickman	Smooth	Red	White	30.24	36.07	3,713	102.9
Mealy	Smooth	Red	White	31.10	35.90	3,969	110.6
Mediterranean	Bearded	Red	Red	29.74	32.99	4,222	127.9
Nigger	Bearded	Red	White	31.44	35.53	3,660	103.0
Nixon	Smooth	Red	White	30.24	35.57	3,778	106.2
Poole	Smooth	Red	Red	31.44	36.06	3,799	105.4
Portage	Smooth	Red	Red	.....	39.78	3,771	94.8
Prosperity	Smooth	Red	White	.....	34.20	3,979	116.3
Red Wave	Smooth	Red	Red	.....	36.29	3,719	102.5
Red Wonder	Bearded	Red	White	28.99	33.38	3,965	118.8
Rudy	Bearded	Red	White	29.10	34.65	3,525	101.7
Trumbull	Smooth	Red	White	.....	37.06	3,826	103.2
Turkey Red	Bearded	Red	White	25.13	29.07	3,624	124.7
Valley	Bearded	Red	White	31.20	35.09	3,989	113.7
Velvet Chaff	Bearded	Red	Red	27.21	31.16	3,711	119.1

[1]Extract from Ohio Agr. Exp. Sta. Bul. 298.

Most of these varieties are quite generally known over the State. Three new names are to be found—names given pure line selections recently developed by this Station. These are the Gladden, Portage and Trumbull. fuller descriptions of which may be found in Bulletin 298.

Of the varieties tested for 18 years, the following are the 10 highest in yield: Dawson's Golden Chaff, Nigger, Poole, Gypsy, Valley, Harvest King, Mealy, Gold Coin, Hickman and Nixon. Since the white wheats are much less satisfactory than the red from the miller's and the baker's standpoints, the first of the 10 varieties cannot be recommended. The next four will be found desirable.

When only the last 8 years of the 18 are considered, the 10 varieties standing highest in yield are: Portage, Dawson's Golden Chaff, Gold Coin, Gladden, Trumbull, Early Red Clawson, Harvest King, Red Wave, Hickman and Poole.

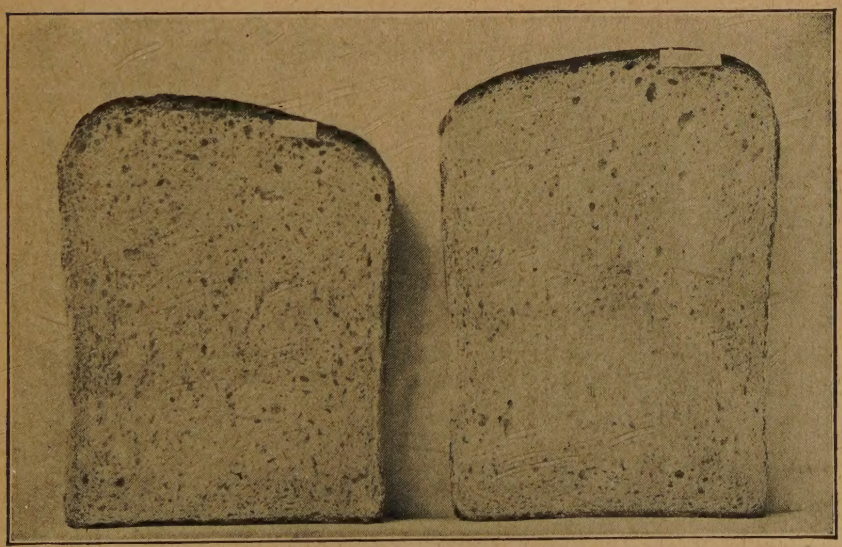
The variety averaging highest in yield of straw per acre is the Gladden, with the Mediterranean second and Early Ripe third. The largest yield of straw per bushel of grain is found in the Mediterranean, with Turkey Red second and Early Ripe third. The Fultzo-Mediterranean and the Portage have the least straw per bushel of grain.

Fifteen of these varieties have been tested for short periods at our district and county experiment farms. It is of interest to compare these results with each other, and with the older work at Wooster. The yields at the different points, as well as the duration of each test, are indicated in Table II.

TABLE II.—Variety tests at district and county experiment farms

Variety	Yield per acre (bushels)							
	Wooster 8 years	German-town 6 years	Carpen-ter 6 years	Han-cock 4 years	Pauld-ing 3 years	Miami 3 years	Hamil-ton 2 years	Cler-mont 2 years
Fultz	34.63	20.44	27.11	16.40	.....	34.18	.....	.....
Fultzo-Mediterranean.	35.38	19.33	24.17	.....	.....	.....	.....	.....
Gladden	37.62	24.76	28.51	.....	43.13	38.48	25.48	17.17
Goens	.....	.....	.....	.....	33.06	39.75	22.01	.....
Gypsy	33.99	23.76	26.95	19.12	.....	37.60	.....	.....
Mediterranean	32.99	20.65	26.52	19.62	32.80	34.96	23.71	16.18
Nigger	35.53	24.03	26.76	16.23	42.60	37.93	26.65	18.51
Poole	36.06	24.03	27.19	17.76	.....	35.69	.....	.....
Portage	39.78	25.88	31.42	.....	41.80	41.48	27.04	16.09
Red Wonder	33.38	21.39	24.49	.....	37.38	.....	.....	.....
Rudy	34.65	22.13	25.24	.....	.....	37.41	.....	15.07
Trumbull	37.06	23.03	28.89	.....	43.42	39.22	.....	.....
Turkey Red	29.07	21.08	23.77	15.24	41.27	35.53	23.95	14.08
Valley	35.09	21.49	26.58	.....	.....	39.62	.....	.....
Velvet Chaff	31.16	20.88	25.34	15.86	37.81	36.13	24.23	16.43

A plot of Gladden wheat (right) and one of Gypsy (left) from which the former was selected. Gladden has excelled the original variety in stiffness of straw, and has yielded 3.63 bushels more per acre at Wooster



Gladden (right) also has better bread-making qualities than the Gypsy wheat (left)

FAKE VARIETIES

There is a tendency on the part of unscrupulous men to adopt old standard varieties of wheat and, without any sort of improvement, to give them a new name and to put them on the market at extravagant prices. This method of procedure is often accompanied with the claim that these newly named varieties do not call for anything like the usual amount of seed per acre. Often the ridiculous claim is made that 1 peck of seed per acre is an abundance. Such claims are resorted to because it is realized that many farmers who would not pay $40 to buy seed for an acre of wheat will pay $20 per bushel if they can be made to believe that 1 peck per acre will prove a good seeding for the variety offered for sale. If a seed dealer uses large enough type and plenty of red ink, he can find an army of men who will accept almost any claims he is bold enough to make.

The exploitation of a variety of wheat known variously as the Marvelous and the Miracle is a case in point. This Station first got hold of it in 1911 under the name of Miracle, and has grown it for the last 5 years beside three standard varieties, with the following results: The 5-year average yield of Gypsy was 31.4 bushels per acre; Fultz, 31.7 bushels; Poole, 33.94 bushels, and Miracle, 28.0 bushels.

In the fall of 1913 the Station obtained what is evidently the same variety under the name of Marvelous, and was assured that 1 peck of seed per acre was a full seeding; indeed, it was urged that more than 1 peck would reduce the yield. This wheat was seeded according to directions at the rate of 1 peck per acre, and also at the rate of 8 pecks, in order to test the validity of the claim. For comparison, the Mediterranean wheat was also seeded at both rates, alternating with the Marvelous. The yields were as follows: Marvelous, seeded at the rate of 1 peck per acre gave a yield of 7.39 bushels per acre; seeded at the rate of 8 pecks, 30.86 bushels per acre. Mediterranean, seeded at the rate of 1 peck per acre gave a yield of 11.41 bushels; at the rate of 8 pecks, 35.86 buhsels. Not only the yields but also the actual count of culms showed that the Marvelous wheat needed as much seed used as the Mediterranean. The former did not possess any unusual qualities as to tillering.

In 1915 the test was repeated, the Marvelous wheat being compared with the Poole and the Fultz. When seeded at the rate of 1 peck per acre, the Marvelous exceeded both the others in yield, by an average of less than 1 bushel per acre, while it was inferior in yield when seeded at the normal rate. All three responded to and required the normal rate of seeding.

WINTER INJURY OF ALFALFA AND CLOVER

C. A. GEARHART

This spring the Ohio Experiment Station received numerous testimonials from various sections of the State concerning winter-killing of alfalfa and clover. It was then thought advisable to send letters of inquiry to a large number of farmers to ascertain the amount and extent of this injury.

Letters were sent to farmers in every county of the State, asking the following questions:

1. What percent of alfalfa two years old or over has winter-killed in your county?
2. What percent of the seedings of alfalfa made in 1915 has winter-killed?
3. Which seedings are in the better condition, spring or midsummer?
4. Have you any Grimm alfalfa growing in your county?
5. Has the Grimm alfalfa come through the winter in better condition than the common alfalfa?
6. Locate fields of Grimm alfalfa in your county.
7. What percent of the new seedings of sweet clover has winter-killed?
8. What percent of the new seedings of red clover has winter-killed?
9. What percent of the new seedings of alsike clover has winter-killed?
10. What percent of the new seedings of mammoth clover has winter-killed?

Answers were received from 56 counties of the State. Many of the correspondents had the questions up for discussion before their farmers' club or grange; therefore, those reports carry the opinions of several in one community. Since so many replies have been received, representing 64 percent of the counties in the State, it seems safe to assume that these figures represent a fair average condition for the entire State.

The data collected on alfalfa 2 years old or over show that 42.3 percent winter-killed this last season. If we divide the State into east and west sections by a line drawn from north to south, separating Sandusky and Erie at the north and Scioto and Lawrence Counties at the South, we find the amount of injury greater in the west half of the State. This may be due in part to the fact that more alfalfa is grown in this section and more reports have been received than from the east half, and in part to the difference in the type of soil found in the two halves of the State. The east half is more sandy and gravelly and does not hold as much moisture as the loam and clay soil of western Ohio, which heaves badly during freezing and thawing weather.

Forty-five and seven-tenths percent of the alfalfa seeded in 1915 has winter-killed, which is a slightly higher figure than that

for the older seedings. Our replies show the spring seedings of 1915 withstood the winter better than the seed sown in the summer. This may be accounted for by the very wet summer which prevented the farmers, in many instances, from seeding their alfalfa as early as they would had it been a normal season. Hence, the young plants were unable to make sufficient growth to withstand the severe winter, and consequently summer seedings winter-killed more extensively than the earlier seedings.

The Station also desired to collect some data on the much-advertised Grimm alfalfa, which has a branching-root system and is reported to withstand severe winters without injury. From the large number of letters received only a few fields of Grimm alfalfa were located. Personal visits were made to two Grimm fields in connection with this work. One farm visited had 125 acres of alfalfa, 14 acres of which was seeded in 1912 with Grimm seed. The entire 125 acres was badly winter-killed. There was little doubt in the minds of the owner and of the inspector but that the plants from the common seed went through the winter in equally as good condition, if not better, than the Grimm alfalfa. Care was taken to examine the plants which had heaved out of the ground from 3 to 4 inches to make sure that they were of the branching-root type.

At the other farm visited a very interesting comparison was found. Seed from North Dakota and from Nebraska and the Grimm were sown under similar conditions in the spring of 1915 with a nurse crop. The superintendent, who has had much experience with alfalfa during the last 15 years, was unable to see any difference in the plots seeded from the different kinds of seed. In fact, I doubt if there was any difference in the present stand or the number of plants winter-killed in the different plots. Unlike the first farm visited the latter had an excellent stand of alfalfa regardless of source of seed.

This test is in accord with the regional tests conducted by this Station. In no case have we obtained better results with the Grimm seed than with the commercial seed obtained from the northwestern states. However, seed obtained from the sections where the climate is warm or irrigation is necessary, tends to kill out to a more marked degree than the northern-grown seed.

Of the many letters received only a few contained any data on sweet clover; therefore it was thought inadvisable to use the information collected in reporting the condition of sweet clover for the entire State.

From the data collected on red clover we must draw the conclusion that it is more hardy or winter-resistant than is alfalfa, as the red clover shows 22.7 percent winter-killing as compared to 44 percent for alfalfa (all seedings for entire State.).

Very little difference was found in the condition of red and of mammoth clover. The latter averaged 22.3 percent winter-killing, or practically the same as red clover.

Alsike clover as shown by the reports is more winter-resistant than any other clover considered. An average for the State shows 17.3 percent injury.

Regardless of any division that may be made of the State, an average of the reports received shows that alsike, red and mammoth clover withstood the winter of 1915-16 better than alfalfa.

FORAGE CROPS FOR SWINE[1]

W. L. ROBISON

The adoption of a forage-crop system which will furnish an ample supply of green feed throughout the growing season offers one of the most promising means of lowering materially the cost of pork production. Green crops, to be of greatest value as pasture for hogs, should be adapted to local soil and climatic conditions; should be palatable; should be able to withstand grazing and trampling; and should furnish a large amount of digestible nutrients with a high protein and mineral content.

The relative values of four green crops in comparison with dry lot feeding are shown in Table I, the results of which are based upon a test which lasted for a period of 75 days, from July 16 to September 29, 1910, when exceptionally dry weather prevailed. All lots received a full feed of corn in addition to the forage.

Twice as large an area of clover as of the other crops was used, because a hay crop had previously been harvested from the clover plot. Its low replacement value per acre shown in the table is due to this fact. In another experiment in which clover, mixed pasture (chiefly bluegrass and white clover), and dry lot were used in connection with a full feed of corn, the amount of pork produced per bushel of corn or its equivalent in cost was 14.4; 13.1; and 10.6 pounds in the order named. Clover replaced 142.2 pounds of corn

[1]Detailed results reported in Ohio Agr. Exp. Sta. Buls. 242 and 268.

per 100 pounds of increase in live weight, while the mixed pasture replaced only 103.5 pounds, thus making the replacement value of an acre of clover and of an acre of mixed pasture $42.09 and $27.52, respectively. In the test reported in Table I, the pigs on clover consumed more grain, made larger daily gains, and required less corn per unit of gain than did the pigs in any of the other lots. Another point in favor of clover is that it fits well in common rotations.

TABLE I.—Relative value of green crops as compared with dry lot feeding

Lot	Forage	Average daily gain	Corn consumed per 100 pounds gain	Corn replaced per 100 pounds gain	Replacement value of one acre of pasture*	Gain per bushel of corn consumed
		Pounds	Pounds	Pounds	Dollars	Pounds
1	None (dry lot)	1.21	448.1	.....	.....	12.497
2	Bluegrass and white clover	1.38	424.9	23.2	7.28	13.180
3	Rape	1.45	384.1	64.0	21.19	14.580
4	Soybeans	1.54	394.5	53.6	18.83	14.195
5	Red clover (second crop)	1.70	376.7	71.4	13.83	14.866

*Corn, 70 cents per bushel.

The Ohio Station has had no opportunity to use alfalfa as a green feed for hogs, but the results secured at other stations indicate that its value is somewhat higher than that of clover. Close grazing is especially harmful to alfalfa.

Rape ranked second in order of efficiency. It has a minimum of crude fiber and produces an abundance of growth of a very palatable nature. In the test reported above, the pigs on soybeans gained more rapidly than those on rape, but the rape had a higher replacement value. Moreover, it should be remembered that the rape would have furnished pasture for a longer time, while the period of the experiment covered practically the entire grazing season for the soybeans.

Bluegrass was more susceptible to drouth than the other crops used in the test. It made a poorer showing than any of the other forages, or than it would have made earlier in the season or under more favorable weather conditions. Bluegrass is of especially high value for early spring use.

Rye is useful for late fall and early spring pasture. Analyses have shown that young plants of a nonleguminous nature, such as rye, wheat, rape and bluegrass, are as rich in nitrogen as are the legumes, and should be classed as nitrogenous feeds. As these plants become older the proportion of nitrogen they carry decreases.

AMOUNT OF GRAIN TO FEED ON FORAGE

Table II shows the results secured in an experiment in which two lots of pigs were given a full feed of corn, with and without tankage, and two other lots were given 75 percent as much of the same concentrates as the first two lots received. These four lots were on good rape pasture and were compared with another lot which was fed corn and tankage without access to green feed.

TABLE II.—Light and heavy feeding on rape pasture

Lot	Rations	Average daily gain per pig	Concentrates consumed per 100 pounds gain	Replacement value of pasture per acre	Cost* per 100 pounds gain
		Pounds	Pounds	Dollars	Dollars
1	Corn, 9; tankage, 1; full feed, dry lot	0.9	384.7	.....	5.29
2	Corn, full fed on rape pasture	1.21	325.4	36.38	4.41
3	Corn, 75 percent full feed on rape pasture	1.06	278.1	35.58	3.99
4	Corn, 9; tankage, 1; full feed on rape pasture	1.47	316.6	33.35	4.63
5	Corn, 9, tankage, 1; 75 percent full feed on rape pasture	1.20	294.0	27.70	4.50

*Corn, 70 cents per bushel; tankage, $50 per ton; pasture, $10 per acre.

The pigs that received 75 percent of a full feed made less rapid gains; but, to produce 100 pounds of gain, required 22.6 pounds less concentrates when tankage was fed and 47.3 pounds less when corn alone was fed, than did those that received a full grain feed. With the lots on the limited grain rations, the rape replaced 90.7 and 106.6 pounds of concentrates per 100 pounds of gain. In the case of the full-fed lots, the replacement value of the pasture amounted to only 59.3 and 68.1 pounds of concentrates per 100 pounds of gain in live weight. When corn alone was fed, the concentrated feed was, of course, less costly per unit of feed than when tankage was fed in connection with the corn.

When tankage was fed with the corn the cost of gains was not greatly different for the full-fed lot and the lot that received 75 percent of a full feed. Of these two rations it will pay to feed the greater amount of concentrates when corn is relatively low in value and pasture high in price or limited in amount, and to limit the grain ration when corn is high priced and pasture plentiful.

When the concentrate consisted of corn alone, there was a greater difference in favor of the limited ration. The pigs that were given all the corn they would eat did not consume enough

green feed to balance the ration. On the basis of the prices given in Table II, they made less economical gains than did those that received a limited allowance of corn.

The extent to which corn should be replaced by green feed will depend largely upon the relative prices of corn and pasture, and the time at which one wishes to market his hogs. By feeding a light grain ration on forage, gains may be produced at a smaller expenditure for grain, though less rapidly, than by feeding a heavy grain ration. The slower rate of gain will necessitate holding the pigs longer, so that the additional labor required, together with the greater risk and interest on the investment, must be taken into account in figuring the cost of production by the two methods. Full feeding will make it possible for the pigs to be marketed sooner, which often is an advantage.

SUPPLEMENTAL VALUE OF GREEN FEEDS

Green feeds have a supplemental value which cannot profitably be overlooked. Table III gives the results of an experiment in which corn alone was compared with corn and tankage, in addition to rape pasture.

TABLE III.—Corn with and without supplement on rape pasture

Lot	Rations	Average concentrates consumed daily per pig	Average daily gain per pig	Concentrates consumed per 100 pounds gain	Cost* of concentrates per 100 pounds gain
		Pounds	Pounds	Pounds	Dollars
1	Corn, 9; tankage, 1; on rape pasture	2.79	1.01	275.8	3.79
2	Corn alone, on rape pasture	2.71	.95	283.4	3.54

*Corn, 70 cents per bushel; tankage, $50 per ton.

The addition of tankage to the ration only slightly increased the rate of gain and reduced the amount of concentrates required per unit of gain. Lots 2 and 4, and 3 and 5, of the experiment reported in Table II, furnish a like comparison and gave similar results. In a test comparing rations of (a) corn, 9 parts; tankage, 1 part; and (b) corn, 19 parts; tankage, 1 part, on mixed pasture, the larger proportion of tankage resulted in a slightly higher rate of gain and a smaller feed requirement per unit of gain, but the advantage was not great enough to make up for the increased cost of the ration that carried the larger proportion of tankage.

Such factors as the age of the pigs, the amount of corn fed, and the character of the forage, should be considered in determining the proportion of supplemental feed that should be used with corn for pigs on green feed. Young pigs need more protein in the ration than is needed by older pigs. In the experiment reported in Table II, it was found that a limited corn allowance on pasture decreased the need for a nitrogenous supplement. The use of green feeds materially reduces, but does not entirely supplant, the need for nitrogenous concentrates.

Plot of rape 51 days after seeding

Plot of rape after hogs had grazed on it for 48 days

RIPENING OF GROWING PARTS OF ORCHARD TREES AND SHRUBBERY

LEAF-SPOT OR SHOT-HOLE DEFOLIATION OF CHERRY AND PLUM

A. D. SELBY

DANGERS FROM UNRIPENED CONDITIONS

During the winter of 1914-15 the losses from winter injury to fruit trees and shrubbery were exceptionally severe. This showed most seriously on younger trees. Mid-season drought had been followed by heavy rainfall in August, and again in October. The trees with unripened growth suffered. In the absence of severe winter weather during the past winter shrubs and trees escaped trouble, though possibly some growth was unripened, since the latter part of the season of 1915 was quite rainy. What may we be able to do to secure proper ripening of woody growths for winter?

CONDITIONS OF RIPENING OR MATURITY OF PARTS

Such ripening of growing parts in woody plants is determined by conditions which insure the *normal seasonal development* of such plants. We sometimes fail to realize that the ripening must come out of the regular processes of the plant's unfolding, growth and fruiting. We can readily see the effects of shortening water supply in cutting down the size of the fruit grown, or in other effects on growth. Can we as readily see beyond the extra vigorous late growth of fruit trees arising from any cause, and realize that such is not prepared to resist severe winter temperatures? Late cultivation may produce such growth. Heavy manuring or heavy applications of nitrogenous fertilizer may cause it. And if the soil in which fruit trees or shrubs are growing is quite rich, liberal rainfall in late summer may lead to trouble when the check of a fruit crop is wanting. Other conditions, such as abnormal warmth of the late season have similar effects. Finally, when from any cause the foliage is stripped from the trees prematurely in July or August the new growth which usually follows defoliation will produce immature tissues all over the tree. These are the usual or average risks that involve growing parts of the tree, while very unusual warm periods in midwinter may bring about swelling of the fruit buds, especially of the peach, in anticipation of the warmth promised, which may be recorded as an abnormal variation beyond our control.

Normal ripening of growth means conditions to secure proper, but not excessive, growth periods, followed by checks upon prolonged growth, such as come from reduced water supply, or from the developing and ripening fruit crop. Underirrigation to withhold water acts as such a check.

CULTIVATION FOLLOWED BY COVER CROPS

In cultivated orchards of practically all kinds the cultivation may be continued too long without danger; hence, in addition to plowing back to the trees or to the other final operations of cultivation, a cover crop is often advisable. Under extreme rankness of growth such a cover crop is necessary. For this purpose rye is often used; soybeans are practicable, especially as a combined all-season practice of soys and cultivation followed by rye or oats. Under special conditions, such as cover crop to crowd out weeds, oats serve extremely well, and being killed by winter freezing are not troublesome later on like rye.

In cultivated or sod-mulch orchards the dangers are much less, but such as occur are commonly traceable to over-application of manure or litter with nitrogenous fertilizer. This may usually be avoided. *All the work above outlined is to be done in advance to avoid the danger.*

LEAF-SPOT AND SHOT-HOLE FUNGUS ON CHERRY AND PLUM

Most varieties of sour cherries, and especially the Morello types, with practically all European varieties of plums, are attacked by a fungus parasitic on the leaves, causing leaf-spot or shot-hole effects, and causing the leaves to turn yellow and drop prematurely, commonly in July or August. This trouble is very general in showery or rainy midseasons, which are favorable to the development of leaf parasites. After defoliation the trees strive to put forth new leaves, and with this process new growth is formed. This means a general condition of unripeness. We have studied numerous cases where cherry and plum trees were very seriously, and at times hopelessly killed by winter freezing following such dropping of leaves and consequent new growth of leaves and shoots.

COPPER SPRAYS AN EFFECTIVE CONTROL OF LEAF SPOT

During the summer of 1915 there was a large amount of leaf-spot trouble on sour cherries, and orchardists reported ineffective or negative results from efforts to use lime-sulphur sprays. The situation has been about the same in the control of the shot-hole spots on plum. The weaker and standard Bordeaux sprays have been effective, followed if necessary by ammoniacal copper carbonate when ripening time of the fruit approaches. The weaker Bordeaux II (2-2-50 formula) consists of 2 pounds of copper sulphate and 2 pounds of lime to 50 gallons of spray. This is recommended for cherries, to be applied at intervals of two to three weeks, beginning the middle of June or earlier, and continued as long as necessary. The standard Bordeaux I (4-4-50 formula) applied at similar intervals, and followed by ammoniacal copper carbonate if needed, is likewise recommended for treatment of European varieties of plums. The American and Japanese varieties do not commonly suffer from this disease. The copper sprays appear to be required to do this work of holding the leaves on the trees, and despite a slight increase of cost at the present time, are certainly cheaper than winter killing of the trees.

Plum leaf attacked by shot-hole fungus

AS TO SHRUBBERY

In dealing with shrubbery there is a restricted field for effort, owing to usual sod planting of ornamentals. The most satisfactory method appears to be to avoid over-late pruning, and to practice quite thorough mulching in late fall with straw or coarse litter—the mulch to be removed in the spring. For privet, the mulch may save killing entirely to the ground in winter, and as a rule will control winter killing on most kinds of shrubbery.

SOME ALKALI SOILS IN OHIO

J. W. AMES

In regions where the rainfall is slight, the soluble salts continually being formed in the soil are not leached out in the drainage water, but are carried upward by capillary water, which on evaporation causes a concentration and subsequent deposit of soluble salts at or near the surface. Such accumulations of salts in soils of arid and semiarid sections of the United States are called "alkali," and generally consist of chlorides, sulphates or carbonates of sodium, potassium, calcium and magnesium, or mixtures of two or more of these salts. While the term "alkali" is applied to soil containing an excessive amount of mineral salts, these salts are not always of an alkaline reaction, or basic character. The accumulation of salts in amounts sufficient to cause a deposit on the surface is not of common occurrence in soils of humid areas where the rainfall is so distributed as to enable the water which percolates down through the soil to wash out any excess of soluble salts.

Distribution in Ohio.—This unusual accumulation of salts has been reported as occurring in several localities in Ohio. So far as they have been observed, the areas affected in this way are located in the southern part of Highland County and in Brown and Clermont Counties.

The soils in this section are silt loams formed from finely ground rock material called "loess," which is believed to have been swept from the valleys on to the upland by the action of wind. These soils are very poorly drained. Indications of the excess of water are seen in the numerous workings of crayfish in this section. Owners of land where the soluble salts carried to the surface by capillary water form a coating on the soil resembling frost, say that this condition is most pronounced after a heavy rainfall. That excessive amounts of salts are contained in the soil water is also indicated by the coating on the sparse vegetation, mostly weeds, growing on these spots.

Salt content of well water.—The water of shallow wells in this vicinity contains considerable amounts of calcium and magnesium sulphates, which indicates that the subsoil water holds excessive amounts of these salts in solution. The analysis of water from a shallow well in Hamersville, Brown County, showed that it contained calcium, magnesium and sulphur equivalent to 96 grains of calcium sulphate and 219 grains of magnesium sulphate per gallon.

Composition of salt formation.—In an area about a mile east of Hamersville several spots were observed where the soluble salts were being carried to the surface and deposited. Examination of the soil showed that it contained amounts of magnesium, aluminum and sulphur equivalent to 4.27 percent magnesium sulphate and 4.9 percent aluminum sulphate. These figures indicate an excessive accumulation of soluble mineral salts in soil receiving more than 30 inches of rainfall annually. An analysis was also made of soil adjacent to the spot where soluble salts accumulated on the surface. Although this soil appeared to be free from salts, it contained appreciable amounts of magnesium and aluminum sulphates. The soils are decidedly acid, the acidity being due to the considerable quantity of aluminum sulphate present.

A similar accumulation of salts was observed between Macon and Winchester, near the eastern boundary of Brown County. This soil was sampled in 1-foot sections to a total depth of 6 feet. An examination of the samples representing the several depths showed the presence of large amounts of water-soluble sulphate and calcium. The surface soil here also contained considerable aluminum sulphate, but no trace of aluminum was found in the samples representing the lower depths. The water extract of surface soil in this case was also strongly acid, but that of the other depths was neutral in reaction. The composition of the soluble salts present in this soil differed from that found in the first soil described in that it was composed of calcium and aluminum sulphates, while the first soil contained magnesium and aluminum sulphates and only a trace of calcium.

The information available concerning the geology of this section of the State does not furnish an explanation as to the source of the excess of salts found. The oxidation of iron sulphide in the soil or subsoil may be a contributing cause of the accumulation of sulphates of calcium and magnesium observed in these cases.

The lack of vegetation on areas affected may not be due altogether to the presence of salts, although this is indicated, but to the poor drainage conditions. The soil being very impervious, it is a question whether the remedies which suggest themselves—namely, drainage and liming—will overcome the difficulty. More information as to the geological formations and a more extended study of the subsoil is necessary before the probable source of the salts found in these soils can be determined.

THE INFLUENCE OF SIRES ON PRODUCTION

C. C. HAYDEN

Selecting a sire.—If breeders could always pick out sires that would transmit the qualities desired, the improvement of dairy cattle would be a simple matter. Much has been written on this subject, discussing it in its various phases; and the conclusion is that there is only one absolute test—the actual production of daughters which meet the requirements. This method of testing requires a long period of time, is expensive and loses to the breeder the use of the sire during the 3 years or more of waiting, and these years are probably the most valuable part of the sire's life. Many men who have built up good herds have lost the results of many years of careful work by the selection of an unworthy sire. A loss of this kind is far greater than one occasioned by the testing out of a sire before using him. No one can afford to do this as well as the man who has a large herd of excellent females, unless it be a group of such breeders or the State.

The next best method is to secure sires as many of whose ancestors have been heavy producers as the breeder can pay for. Selection in this manner is a game of chance in which we make the chance in our favor as great as is consistent with our available funds. Fortunate, indeed, is the breeder who does not draw an unlucky number at some time. He is the exception if he has been in the business long enough to make use of four or more sires.

Selections in the Station dairy herd.—In this connection, it is interesting to note the results of the use of various bulls in the Station dairy herd. It is almost impossible to make an absolutely fair comparison of the progeny of two sires for the following reasons: The same dams cannot all be retained in the herd; usually not all daughters can be retained until maturity; methods of feeding and care may change during the years between the first records of the dams and one or more records of their granddaughters.

In the results which follow, some of the inferior animals have been removed from the herd. Such selection of course operates in favor of the poor sire.

A sire is kept for each of the two breeds in the Station herd. However, the breed has nothing to do with the cause of the results obtained. Prepotency in good or bad characteristics occurs in all breeds.

Results in Group One.—The first bull used on the first group of cows came from a dam which had a good official record, and the granddam on the sire's side had a record of large production. His sire was more noted as a show-ring favorite than as a sire of producing daughters. The cows on which this sire was used produced, on the average, as follows (all records here given cover one year from the birth of each calf or such part of one year as the lactation period covered):

One year from first calf, 6,135 pounds of milk and 198 pounds of fat.
One year from each calf, 7,392 pounds of milk and 231 pounds of fat.

The daughters of these cows by the bull mentioned above produced as follows:

One year from first calf, 8,037 pounds of milk and 258 pounds of fat.
One year from each calf, 8,568 pounds of milk and 273 pounds of fat.

This shows an average gain of the daughters over their dams of 1,902 pounds of milk and 60 pounds of fat for the first year, and an average yearly difference of 1,176 pounds of milk and 42 pounds of fat for all periods. With butterfat worth 30 cents per pound this gives each heifer an increased production value annually of more than $12. If she produced for 6 years the total increase valued for production would be $72. This does not take into account her increase in value for breeding purposes.

A second bull was selected for this group, the price paid being about twice that for the first bull. He had better records of production back of him and the results justified the greater expenditure. He was used on the original cows and their daughters by the previous bull. The average production of his daughters was as follows:

One year from first calf, 10,209 pounds of milk and 354 pounds of fat.
One year from each calf, 11,599 pounds of milk and 384 pounds of fat.

The gain over the original dams by the use of this bull was for the first calf 4,074 pounds of milk and 156 pounds of fat; and for one year of all lactation periods, 4,207 pounds of milk and 153 pounds of fat. The gain over the daughters of the previous bull was for the first year only 2,172 pounds of milk and 96 pounds of fat; and for one year of each lactation period, 3,031 pounds of milk and 111 pounds of fat. Several of the last heifers have had but one year's production, and additional years will probably show greater gains. It is probable that some of the increased production was due to better feeding and care, though the herd has always been reasonably well fed.

No. 70.—A daughter of sire No. 1 in Group 1. She was given better care the 4th year than the main herd

	Milk	Fat	80 percent butter
1st year	8,404 lb.	279.6 lb.	349.5 lb.
2nd year	7,851 lb.	282.0 lb.	352.5 lb.
3d year	5,688 lb.	304.8 lb.	381.0 lb.
4th year	13,121 lb.	437.1 lb.	546.3 lb.

No. 108.—A daughter of No. 70 by sire No. 2 in Group 1. She was given better care than the main herd. Record made as a junior two-year old

	Milk	Fat	80 percent butter
1st year	14,231 lb.	507 lb.	633.4 lb.

Taking the increase of the daughters of the second bull over the original dams at 30 cents per pound of fat, gives them an increased annual value for production of $45.90. This for 6 years would be $275.40. Cows of this capacity would consume more feed than their dams of less capacity, which must be considered in figuring value. This difference on 10 daughters would make this sire worth $2,750 more than one that would have caused no increase.

Results in Group Two.—The first bull used on this group was selected from one of the best herds in Ohio, though his sire and dam had no official records. Not all the early records of the cows on which this bull was used are available; therefore, a comparison of first lactation periods cannot be made. The original dams and daughters average in all lactation periods for which records are available, as follows:

Average of dams, 5,275 pounds of milk and 287 pounds of fat.
Average of daughters, 4,588 pounds of milk and 248 pounds of fat.

This decrease of 687 pounds of milk and 39 pounds of fat shows that the use of this sire greatly reduced the productive capacity. His *double* daughters produced 3,520 pounds of milk and 202 pounds of fat, or a decrease of 521 pounds of milk and 32 pounds of fat below *their* dams.

The daughters of the second bull used on this group show an increase over the daughters of the first bull, of 752 pounds of milk and 32 pounds of fat per year. For the first lactation period only, they show an increase of 1,205 pounds of milk and 49 pounds of fat, indicating that they will be far superior to the daughters of the first bull when they are mature. Most of them have had but one lactation period. At the time this second bull was purchased, his ancestry had no official records, but his dam was said to be a heavy persistent milker and his sire was imported. In standard of production, this group is now practically where it was 10 years ago because of one unfortunate selection. However, the group has increased in numbers.

The males.—Besides the loss in production, there has been another loss due to the fact that it has not been advisable to sell the males from this second group for breeding purposes. Therefore, they have been disposed of for nothing or for a very small sum. This is an important item which should be taken into consideration when estimating the amount one can afford to pay for a bull of good breeding.

Results of Missouri Station.—A similar report from the University of Missouri shows the following increase or decrease from the records of their dams:

1st bull—decrease 1,009 pounds of milk and 18 pounds of fat.
2d bull—decrease 393 pounds of milk and increase 14 pounds of fat.
3d bull—increase 1,400 pounds of milk and 66 pounds of fat.
4th bull—increase 3,230 pounds of milk and 146 pounds of fat.
5th bull—increase 55 pounds of milk and 4 pounds of fat.
6th bull—decrease 1,734 pounds of milk and 76 pounds of fat.
7th bull—increase 335 pounds of milk and 35 pounds of fat.

Of the eleven sires used in these two herds, three were decidedly inferior; two were practically neutral, and six were superior in their transmitting powers. If under reasonably careful selection, nearly one-half the sires are inferior or indifferent, what must the proportion be where careless selections are made?

SOME LESSONS FROM THE WHEAT CROP OF 1915

THE WOOSTER EXPERIMENTS

C. E. THORNE

The wheat harvest opened in Ohio a year ago with the promise of a bountiful yield, but over a large part of the State the weather conditions through July and August were such as to make it very difficult to save the crop. At the Wayne County farm of the Experiment Station tile-drained land and a supply of shock covers made it possible to harvest and thresh the crop in fair condition.

The land which has grown wheat continuously since 1894 yielded 10 bushels per acre on the unfertilized part—a larger yield than it has given for 12 years, and raising the average unfertilized yield for the 22 years to 7½ bushels. The annual dressing of 5 tons of yard manure increased the yield to 23.8 bushels for 1915, and to 18 bushels for the 22-year average, and 430 pounds of a complete fertilizer, costing $8.50 at prices current before the European war, raised the yield for 1915 to 22.6 busels and for the 22 years to 19.3 bushels.

Where wheat has been grown in a 3-year rotation of corn, wheat and clover, since 1898, the unfertilized yield for 1915 was 17.3 bushels, and for the 18 years, 11.9 bushels. The residue of clover roots and stubble, left after the corn has taken out its fill,

has therefore enabled the wheat to increase its yield by nearly 4½ bushels per acre for the entire period, and by more than 7 bushels in 1915.

When the corn grown in this rotation has received 8 tons per acre of yard manure, the wheat and clover receiving no further treatment, thus making the manure dressing equivalent to 2⅔ tons annually, the yield of wheat was 24 bushels per acre in 1915, or practically the same as that of the continuously grown wheat receiving a direct application of 5 tons of manure every year, and the 18-year average has been 20.7 bushels. When this manure has been dusted with acid phosphate, 40 pounds to the ton of manure, the yield of wheat has been 29.8 bushels per acre in 1915 and 26.6 bushels for the 18 years. These yields, be it remembered, are what the wheat has made from the crumbs that the corn crop, which eats at the first table in this experiment, has condescended to leave behind; the wheat receiving no direct treatment.

In another 3-year rotation wheat follows potatoes in a rotation of potatoes, wheat and clover, which was begun in 1894. In this test the unfertilized wheat yielded 33.7 bushels per acre in 1915, and has averaged 26 bushels for 21 years. Where both potatoes and wheat have received acid phosphate, 160 pounds on each crop, the wheat yield rose to 39 bushels in 1915, and has averaged 35.4 bushels for the entire period. The addition to the acid phosphate of muriate of potash, 100 pounds each for potatoes and wheat, has increased the yield of wheat to 40.7 bushels for 1915, and to 35.6 bushels for the entire period—an increase over the phosphate alone not sufficient to justify the use of the potash, even at former prices, so far as the wheat crop is concerned; the potatoes, however, have paid for the potash. A further addition of nitrate of soda, 80 pounds per acre on potatoes and 160 pounds on wheat, raised the wheat yield for 1915 to 43.2 bushels and for the 21 years to 37.7 bushels, or an average increase of 11.7 bushels over the unfertilized yield of 26 bushels. This is the same fertilizer, costing $8.50 per acre, which has raised the continuously grown wheat from 7.5 to 19.3 bushels, or an average increase of 11.8 bushels.

In the 5-year rotation of corn, oats, wheat, clover and timothy, the unfertilized yield was 8.7 bushels per acre for 1915 and 10.6 bushels as the 22-year average on land that has never been limed, as against 15 bushels for 1915 and 11.7 bushels for the 22 years on land that had a ton of quicklime per acre in 1903, and 2 tons of ground limestone 10 years later.

Acid phosphate, 160 pounds per acre, increased the yield for 1915 to 18.6 bushels on the unlimed land and to 20 bushels on the

limed land. One hundred pounds of muriate of potash, added to the acid phosphate, has produced a further increase of a bushel per acre for the 22 years in both cases, and the complete fertilizer, made up of acid phosphate, muriate of potash and nitrate of soda, in the same quantities given for the experiments before described, and costing $8.50 per acre, increased the yield for 1915 to 33 bushels on both unlimed and limed land, and to 27.5 bushels for the 22 years, the nitrate of soda partly taking the place of lime.

This 22-year average of 27.5 bushels has been produced alongside of land yielding for the same period 10.6 bushels without lime, or 11.7 bushels with partial liming, a gain of between 16 and 17 bushels for the fertilizer; or, if wheat be rated at a dollar a bushel, about two dollars worth of wheat for one dollar expended in fertilizers.

These experiments have all been made on small plots, of one-twentieth to one-tenth acre; but a 40-acre field at the Station has grown 10 acres of wheat every year for 22 years in a 4-year rotation of corn, oats, wheat and clover. During the first 10 years of this period the wheat land was top-dressed before seeding with yard manure, about 10 tons per acre, and the 10-year average yield was 20 bushels per acre. The system was then changed and the manure was reinforced with phosphate, about 40 pounds to the ton of manure, and was kept under cover until fall, when it was spread on the clover sod, to be plowed under for corn; the corn received a dressing of limestone, about a ton and a half per acre for every corn crop, and the wheat received 350 pounds per acre of a fertilizer made up of steamed bonemeal, acid phosphate and muriate of potash, with 50 pounds of nitrate of soda added in April if the growth was not so rank as to show danger of lodging. The outcome of this treatment has been an average yield of 34 bushels of wheat per acre for 10 years, the yield for 1915 being nearly 36 bushels.

In this case the phosphating of the manure has cost about $3 per acre, the limestone about $5 and the fertilizer about $6, or a total of $14 for each 4-year period, all laid on the land, and the increase in yield over that of the former period has been 14 bushels of wheat, a ton and a half of hay, 30 bushels of corn and 10 bushels of oats—all worth at least $40, or $10 annually more than the cost of the fertilizers and lime.

Of course it has cost something to harvest these larger crops; but it costs less than half as much to plow and seed one acre for a 34-bushel yield as to plow and seed the more than than two acres which are required to produce that yield on the average Ohio farm.

CROWN GALL ON RASPBERRIES AND BLACKBERRIES

PAUL THAYER

Of the various truck and berry crops for orchard interplanting, the raspberry has recently been discriminated against on the ground that it harbored crown gall, which may be transmitted to the trees. Concerning this claim we have just received some interesting evidence.

In 1911 the Horticultural Department planted a variety blackberry and raspberry plantation just west of the vineyard. With later additions there were 99 rows of 18 feet each, including all the leading varieties of blackberries, black caps, red, yellow and purple raspberries. It seems that in previous years this piece of ground, or part of it, had been used as a berry patch and this is the probable explanation of root-gall infection.

This spring (1916) the plantation was dug out and the plants were inspected. Out of 28 rows of black and purple raspberries not a single sound plant was found. Out of 37 rows of red and yellow raspberries not one variety was found free from root gall. The manner of growth of the red raspberry precludes the possibility of determining whether individual plants were free from the disease.

There seems to be considerable variation in amount of infection. Thus Clark, a variety showing evidence of European blood, was almost free; Dan Scriber and Herbert showed little infection; Cuthbert, Red Diamond, Golden Queen, Idaho and Marlboro were quite seriously affected; while Red Merville, another European variety, was very seriously affected, many of the canes bearing tumors on the stems above ground.

In marked contrast to the uniformity of infection of the raspberries was the marked immunity of the blackberries. With the exception of a few nodules found in a row of Lawton and a few affected canes found in a row of McDonald (a half trailing, southern variety from Texas) there was not a single nodule on any of our native blackberries. One affected plant was found in the row of Oregon Evergreen and numerous large galls on the roots of Himalaya. The Nanticoke showed numerous large galls. The thorns, fruit and general habit of this variety suggest that it is related to Himalaya. With these exceptions the blackberries were perfectly clean.

The Loganberry is a hybrid between the raspberry and blackberry. A row of Loganberry and one of Loganberry seedlings showed serious infection.

THE IODINE CONTENT OF FOODS

E. B. FORBES

Among the several mineral elements present in foods in minute quantities especial interest attaches to iodine because of its importance in metabolism. The only tissue in the bodies of vertebrate animals which contains iodine in apparently essential relations is the thyroid gland. The iodine content of the thyroid may be increased by the administration of iodine; one of the active principles of the thyroid is its iodine-containing constituent; and goiter in certain stages responds favorably to iodine treatment. Further, there is a marked and continuous local prevalence of goiter in many regions. These facts furnish sufficient basis for our interest in the iodine content of foods.

In our study iodine was estimated in 927 samples of animal and vegetable products. These products were in part common foods from the market; a large number were from the fertilizer plots of the experiment stations of the country; others were from regions of interest because of the extreme prevalence or rarity of goiter; still others were products from an extensive metabolism experiment with milch cows. The method of estimation used was accurate to three-millionths of a gram of iodine.

About one food sample in five contained iodine. The amounts present were usually too small for expression otherwise than as traces. In 18 samples each of cow's milk, urine and feces no iodine was found. Iodine was found in considerable quantity only in agar and in Irish moss (from which *blanc mange* is made). No other seaweeds were examined. No iodine was found in 16 samples of table salt or in any one of seven kinds of nuts. It is very rarely present in spices and condiments.

Among the animal products the only one containing iodine in more than traces was hair and hoof, from swine, a sample prepared in the course of a complete chemical accounting for the bodies of some experimental subjects. Traces were found in butter, in eggs, and in several kinds (but by no means in all samples examined) of meat, fish and crustacea (shrimp and lobster).

Among the cereals iodine was found as an uncommon constituent, usually in traces only. None of the fruits contained more than the smallest recognizable traces of iodine, and very few contained even so much.

Among the garden vegetables and root crops beets rather commonly contained traces of iodine (9 samples out of 25), and in one

case a larger amount. Two out of three samples of cucumber contained iodine; also one out of three samples of celery. Iodine was found in single samples of endive, kohl rabi and lettuce. Among onions five samples out of 15 contained iodine, and in parsnips two out of six. Six samples of potatoes out of 21 contained iodine; it was also found in spinach and in rhubarb. We found iodine in one sample of turnips out of 11, but none in tomatoes, pumpkin and squash.

Of the hays, silage and forage crops about one sample in four contained iodine. Among leguminous seeds iodine was found in 11 samples out of 32, more commonly among beans, peas and cowpeas than among soybeans.

The manufactured foods, and milling and manufactory by-products contained iodine in 13 samples out of 25; of those containing iodine 10 were made from cereals. The offal portions of the grains are apparently richer in iodine than the more starchy parts.

The more important sources of iodine in the human dietary, then, are the garden vegetables, though some is also found in the cereal foods and in several foods of animal origin, mostly of the sorts less commonly used.

Among the foods used by livestock the more important sources of iodine are the hay, silage and forage crops, and also the milling and manufactory by-products, comparatively little being found in the natural grain foods.

No consistent or orderly geographic distribution of iodine in foods was revealed; nor were there noticeable effects of the type of soil or method of fertilization on the iodine content of foods. We found nothing characteristic in the iodine content of foods from regions where goiter was especially prevalent. The iodine content of samples of the same crop from different plots of the same field sometimes varied greatly.

The general conclusion from this study was that iodine is a comparatively unusual food constituent and that its presence is commonly accidental in the sense of standing in no essential relation to the growth of the food products. Variations in the iodine content of foods were not successfully related to any associated conditions.

The general effect of this study is to direct us toward the consideration of other conditions affecting the iodine content of the thyroid in the search for the cause of goiter.

TWO TROUBLESOME PESTS OF MAN

R. D. WHITMARSH

CHIGGERS OR JIGGERS

Jiggers, also known as chiggers, harvest mites and red bugs, are very small creatures most common to the South although sections as far north as Ohio are not exempt. Personally, I have had experience with them near Lakeside, Ohio, along the shore of Lake Erie, and from various other reports I believe that they are pretty well distributed in many localities of the State. These mites are not insects, as some people suppose, but belong to the same class as the spiders, the adults having four pairs of legs, whereas true insects in the adult stage have but three pairs. The six-legged larval forms of mites are of a bright red color; and it is only in this stage that they are annoying to man, when if opportunity affords they will burrow under the skin, causing inflammation. The severity of the attack depends upon the susceptibility of the person afflicted. This state of burrowing under the skin, however, is not normal and results in the death of the jigger.

Leptus americanus at left; *Leptus irritans* at right. Highly magnified, dots under anal extremity indicating natural size (after Riley).

In infested localities they are commonly found in high grass, weeds, berry bushes and shrubbery of various kinds, being most abundant in moist localities along bodies of water, and the edges of forest which afford plenty of shade. One walking in infested areas is usually attacked at the ankles near the shoetops, but when working in infested areas any part of the body exposed is subject to attack.

Habits and nature of injury.—Jiggers are familiar to some people from their habit of gathering under the wings of the housefly and on the underside of grasshoppers. The most common species annoying to man is scientifically known as *Leptus irritans.* They

are in their larval forms normally parasitic on insects. After attaching itself to its host, the jigger inserts its beak and saps the juices. Upon becoming full fed, it drops to the ground and, in some sheltered place, eventually changes to the adult stage. In this latter, or eight-legged stage, it does not trouble man, but feeds on small insects, showing a great liking for small caterpillars and plant lice. The adults lay their minute, brown eggs on the ground, frequently several hundred in one place. There seems to be but a single generation in a year, the adults hibernating over winter in the soil or other protected places.

Children and people with thin skins are most troubled by jiggers; and it is, therefore, unwise to allow children to wander about with their skin exposed to the attacks of these pests, as the inflammation caused may be quite severe in some cases. Some people, such as farm laborers, in badly infested areas are practically immune from the attack of these pests. This may be due to the fact that such persons are naturally tough skinned, especially on such portions of the arms and legs as become tanned by sun and weather.

After the insect burrows under the skin, a small, red spot soon appears, which is probably the mite inflated with human blood; and after a short while an inflamed area, sometimes one-half inch or more in diameter, appears about this point. This inflamed area may appear within a few hours after the mite has entered the flesh, but the inflammation, as a general rule, reaches its height on the second day. The inflamed areas are many times mistaken for hives, or nettle rash, and in many cases look a great deal like inflamed areas caused on some people by the bites of mosquitoes and fleas. However, the work of the mites can generally be diagnosed after the second or third day by the central point of the inflamed area being surmounted by a minute water blister. The irritation caused by the mites is so severe in some cases that the patient becomes almost frantic, and rare cases have been recorded of erysipelas and death by blood poisoning following severe scratching.

Means of prevention and control.—Of course, the best means of prevention of attack consists in susceptible people avoiding infested areas, that is, not walking among infested shrubbery, or sitting or lying in grass along streams or marshes, or under trees bordering such localities. However, if one has been exposed, little ill effect will be felt if a bath is taken in hot salt water or with strong soap a short time after the exposure. After long exposure, however, the bath has no effect. After one has been exposed for some time,

a counterirritant or cooling substance should be applied to the injured parts. Quite strong ammonia applied when symptoms are first noticed is about as good a remedy as one can find. Strong solutions of common cooking soda or saleratus are also good. These solutions should be applied liberally until relieved. They counteract the poisons produced by the mite, which are acid. I have found gasoline and turpentine especially satisfactory when applied in small quantities to inflamed areas, but these might not be satisfactory for some people. A dilute solution of iodine or collodion is quite effective in some cases. Camphor and alcohol are cooling, but their effects are not usually lasting. Sulphur is rated as one of the best substances to prevent attack, and it is well for one anticipating going into infested areas to dust flowers of sulphur in stockings and underclothes, especially below the knees. Naptholene is also said to be good when used in the same way.

We often have requests for methods of exterminating these pests about the grounds of country clubs and private estates. This can generally be accomplished by keeping grass, weeds and other useless plants, mowed close so as to expose the mites to the strong sunlight. Favorable reports come from pasturing infested areas with sheep, due undoubtedly to the fact that sheep keep the grass cropped shorter than cattle do. It is also believed that jiggers crawl up the legs of the sheep and are killed by the oil of the wool. Another remedy consists in dusting grass and similarly infested areas with flowers of sulphur. About 50 pounds of sulphur per acre is the right amount. This dusting may be accomplished by the use of one of the dust blowers, such as a potato dust blower; or on large estates it would be well to purchase one of the larger dusting outfits which are put on the market at the present time, costing about $100.

PUNKIES

Punkies, no-see-um or sand flies, have been noticeably abundant in the Killbuck bottoms about Wooster this spring, and have been reported by several people as being extremely annoying to both man and beast. Almost everyone testifies that he has never noticed these pests before, probably for the reason that they have never before been nearly as abundant as this year. Prof. James Hine, of the Ohio State University, has identified the species so troublesome in this locality, as *Culicoides variipennis*.

These small flies are grayish-black in color, have clouded wings, and measure a little more than one-sixteenth of an inch in length.

Nature of injury.—Punkies will bite any exposed part of the body, but prefer the hairy parts. They bite fiercely and fill up with blood almost to the bursting point. One can catch or kill them very easily, as they are not readily disturbed until they get their fill of blood. They are particularly harassing to horses and cattle in the early morning and about sundown, when there is little wind blowing. I have found them on horses especially abundant about the head and neck. They apparently stand on their heads in piercing the skin of the animals and in a short time become greatly inflated with blood. These insects often cause severe itching, and some persons present much the same appearance as if they had been exposed to poison ivy. Campers are frequently disturbed by the insects, as they are generally most abundant near bodies of water or damp, shaded portions of forests. The effect of the bite depends, of course, upon the susceptibility of the person attacked.

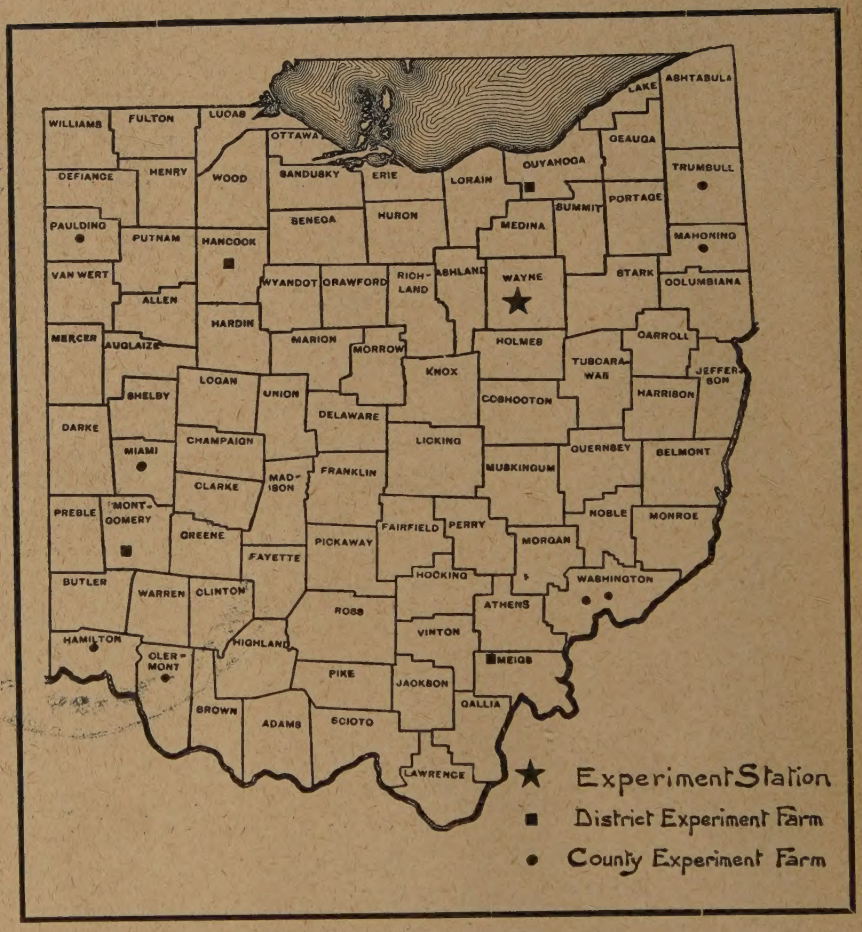
Dorsal view and side view of punky (*Culicoides variipennis*)

Methods of prevention and control.—So far as known, but little can be done to control punkies. Screens are practically useless in keeping them out of camps and houses in infested areas, as they are so small that they pass through any of the ordinary meshed screens. Smudges are useful in driving them away from camps. This may be accomplished by throwing evergreen branches, moss or similar substance, on the fire, which will make a heavy smoke. The burning of pyrethrum in tents or houses will drive out the pests. It is probable that oil of citronella or similar substances would repel the insects, but no evidence on this point is at hand.

RECENT TECHNICAL BULLETINS

The following bulletins in the "Technical Series" may be obtained by writing to the Experiment Station, Wooster:

No. 290—Varieties of Apples in Ohio.
" 291—Experiments with Laying Hens.
" 292—Sulphur in Relation to Soils and Crops.
" 293—The Grape-Berry Worm.
" 294—Wool Studies.
" 295—The Mineral Metabolism of the Milch Cow.
" 297—The Clover Leaf Tyer.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